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ABSTRACT

Whereas previous research on writing focused on measurable aspects of written products, more recent research has focused on the processes of writing, using such research methodologies as laboratory case studies, naturalistic studies, quasiproduct studies that interpret results in terms of process, and studies that have unique procedures as a focus. In laboratory case studies, participants most frequently compose alone in a writing area theoretically free from distraction while researchers make notes about the writers' behavior during composing. Naturalistic studies take place within an ordinary setting for writing with the investigator as a participant-observer. Quasiproduct studies deal with revising activities. Drafts of compositions are collected, photocopied, and analyzed. Unique procedures are used to investigate a particular facet of the composing process such as the use of a particular writing implement. Information derived from using these new methodologies has discredited the strict linear model of the composing process: prewriting, writing, and postwriting. Rather, the information has verified what most competent writers know intuitively about the recursiveness of the writing process and about the subprocesses of composing: planning (setting goals and generating and/or organizing ideas), translating (transforming thought into its graphic representation), reviewing (appraising what has been done and what needs to be done), and revising (mentally changing the content and structure of the discourse as well as changing the actual text). (HOD)

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RESEARCH ON THE COMPOSING PROCESS: METHODOLOGY, RESULTS, AND LIMITATIONS

Ann Humes

ABSTRACT

Methods followed in recent research on the composing process are discussed: laboratory case studies of the composing process, naturalistic studies, quasi-product studies that interpret results in terms of the process, and studies that utilize somewhat unique procedures. The results of the research are presented in terms of the process and of the subprocesses of writing (planning, translating, reviewing, and revising). Limitations of the methodologies are explored, and conclusions about the corpus of results are presented.

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RESEARCH ON THE COMPOSING PROCESS: METHODOLOGY, RESULTS, AND LIMITATIONS

Ann Humes

Researchers have long been more interested in students' ability to read than in their ability to write. Recently, however, the research community has turned more of its attention toward writing. Although the amount of writing research is still relatively meager, it has during the past few years produced promising information regarding the composing process. Furthermore, writing research has undergone a methodological transformation: Research techniques have expanded beyond the classical experimental paradigm traditionally used in studies of writing (i.e., including both experimental and control groups, applying a specific treatment, and measuring post-treatment effects) to include a broader array of methods for investigating the composing process.

This paper first discusses the methodologies used in recent research on the composing process. It then presents the results of that research in terms of the process and subprocesses of writing. It closes by discussing limitations of the methodologies and conclusions about the results.

METHODOLOGY

In comparison with what is known about human perception activities, relatively little is understood about human production activities such as writing, singing, whistling, drawing, and computer programming (Gould, 1980). This lack of knowledge results partially from a corresponding lack of valid and reliable experimental strategies and techniques for studying production tasks.

Until the last decade, the methodology was dominated by the comparative experimental method popular in psychology. Research focused on measurable aspects of written products rather than on the behavior of the producers of those products.

Recently, however, research interest in the processes of writing has burgeoned (Emig, 1982). Now the research methodologies include laboratory case studies of the composing process, naturalistic studies, quasi-product studies that interpret results in terms of process, and studies that have unique procedures as a research focus. These newer categories of studies are the focus of this paper. Consequently, not treated here are studies that analyze written products per se (e.g., Crowhurst & Piche, 1979; Stahl, 1974), studies of the language development of students as determined by their written discourse (e.g., Hunt, 1965; Loban, 1976), and studies investigating the effects of instruction, such as those on sentence combining (e.g., Mellon, 1969; O'Hare, 1973).

CASE STUDIES

The roots of laboratory case studies of the composing process are usually traced to the work of Janet Emig (1971). Emig studied the composing processes of eight high school seniors, selected by their teachers as good writers. The students met four times with the investigator and composed orally while composing on paper. Emig observed them during their writing, making notes and recording the oral composing. All eight students were also interviewed.

Participants in laboratory case studies vary in number from one (e.g., Mischel, 1974) to 84 (e.g., Van Bruggen, 1946). However, following Emig's model, researchers generally limit participants to fewer than 20 because of the complexities of data collection and analysis. Participants most frequently compose alone in a writing area theoretically free from distraction (e.g., Matsuhashi, 1981; Perl, 1979). These participants occasionally have been elementary students (e.g., Sawkins, 1975) or junior high students (e.g., Van Bruggen, 1946), but more often they are high school students (e.g., Emig, 1971; Matsuhashi, 1981; Mischel, 1974; Stallard, 1974), college students (e.g., Flower & Hayes, 1981b; Perl, 1979), or experienced adults (e.g., Gould, 1980). Sometimes experts and relatively inexperienced writers are compared (e.g., Flower & Hayes, 1981b; Gould, 1980).

In some studies, the researcher is in the same room with the writer, observing within the writer's view (e.g., Emig, 1971) or through a one-way screen (e.g., Van Bruggen, 1946). Sometimes the researcher observes outside the room on a videotape monitor (e.g., Matsuhashi, 1981).

Researchers make notes about the writer's behavior during composing (e.g., Emig, 1971; Matsuhashi, 1981; Perl, 1979), recording such activities as energetic spurts of writing or revising. These notes often guide interviews with the writers in order to stimulate their memories of the reasons for a particular composing behavior (e.g., Pianko, 1979). Interviews usually take place immediately after composing so that participants can give accurate information (e.g., Pianko, 1971; Stallard, 1974). Most are interviewed individually to prevent them from repeating answers that they hear other participants give. Interviews often include questions about various aspects of writing activities and attitudes toward writing (e.g., Emig, 1971; Pianko, 1979).

Some researchers either assign or let writers select topics ahead of time, encouraging participants to rehearse and plan (e.g., Emig, 1971; Matsuhashi, 1981; Sommers, 1980). Other researchers assign predesignated topics, combining preparation into the composing observed (e.g., Flower & Hayes, 1981b; Gould, 1980).

Several researchers time behaviors such as reading and revising (e.g., Glassner, 1980; Matsuhashi, 1981; Perl, 1979; Pianko, 1979). Another behavior frequently investigated by timing methods is the pause phenomenon. Pause research can be traced back to 1946, when John Van Bruggen set out to study the rate of the flow of words during composing. Van Bruggen tackled the problem of studying the composing process in that pre-computer era by designing an elaborate system to record the regularity of the flow of participants' words during writing. This unusual system used a time-recording kymograph, motor-driven rollers, a motor-driven punch over a magnetic coil, a disc with evenly spaced

wires, copper springs, magnetic coils, and a copper stylus. The noisy part of the system was located in a room across from the studio where the writer composed. While the participant wrote, an examiner, who sat behind a one-way screen with the stylus and the pressure-measuring device, simulated the participant's writing bursts and pauses by touching and lifting the stylus in synchrony with the writer's movements. Pause-research technology, with its access to computers and videotape, has come a long way from Van Bruggen's pioneering system.

Writers' pauses are an important topic for composing-process research because pausing consumes more than half the writer's composing time (e.g., Gould, 1980; Matsuhashi, 1981). Some researchers examine the lengths of pauses between individual words, syntactic structures, or units of meaning (e.g., Flower & Hayes, 1981b; Matsuhashi, 1981). Others investigate the total length of time that writers pause while composing a whole piece of discourse (e.g., Gould, 1980). Researchers claim that

> the lengths of pauses, a measurable feature of writing behavior, and their location in the text . . . provide a temporal taxonomy or description of the real-time aspects of written-language production from which inferences about planning and decision-making can be made. (Matsuhashi, 1981, p. 114)

Still other case studies require participants to talk while they compose. Some writers say only the words that they are drafting (e.g., Emig, 1971), while others report on what they are thinking (e.g., Berkenkotter, 1982; Flower & Hayes, 1981b). This oral composing is tape-recorded. The audio-recordings (and, when available, concomitant videorecordings [e.g., Flower & Hayes, 1981b]) are often subjected to protocol analysis, which cognitive psychologists consider a powerful tool for identifying psychological processes (Flower & Hayes, 1980a).

A protocol is a detailed, time-ordered record of a writer's composing behavior, including a transcript of the writer's verbalizing during composing, as well as all the written material he or she produces (Flower & Hayes, 1980a). For a protocol, writers "are asked to say aloud everything they think and everything that occurs to them while performing the task, no matter how trivial it may seem. Even with such explicit instructions, however, subjects may forget and fall silent" (Hayes & Flower, 1980b, p. 4).

In analyzing protocols, the researcher infers the underlying psychological processes by which the writer performs the task (Hayes & Flower, 1980b). Writing processes are "identified by matching the verbal protocol word for word with the writer's notes and text" (p. 21).

Flower and Hayes (1980a) have collected and analyzed many protocols in recent years. They report that a typical protocol from a one-hour session will include four to five pages of a writer's notes and text as well as a 15-page manuscript typed from the taperecording. Perl (1979) has developed an elaborate, effective coding system for protocol analysis. The system divides writers' behavior into 16 major categories and 15 subcategories. The coding system is complemented by Perl's numbering system for a time line, which allows her to time each writing behavior. From the coding and timing data, one can derive the following information:

(1) the amount of time spent during prewriting;

(2) the strategies used during prewriting;

(3) the amount of time spent writing each sentence;

(4) the behaviors that occur while each sentence is being written;

(5) when sentences are written in groups or "chunks" (fluent writing);

(6) when sentences are written in isolation (choppy or sporadic writing);

(7) the amount of time spent between sentences;

(8) the behaviors that occur between sentences;

(9) when editing occurs (during the writing of sentences, between sentences, in the time between drafts);

(10) the frequency of editing behavior;

(11) the nature of the editing operations; and

(12) where and in what frequency pauses or periods of silence occur in the process. (p. 322)

A far less complex protocol technique is used by Lillian Bridwell, who calls her procedure "the poor woman's protocol analysis" (Bridwell, 1981b). Bridwell asks writers to make notes, in the margins of their compositions, on what they are thinking about as they compose.

NATURALISTIC STUDIES

In contrast to studies dealing with writers who compose in a laboratory, naturalistic studies take place within an ordinary setting for writing, whether that setting is the professional writer's context for composing (Berkenkotter, 1982) or the classroom (e.g., Edelsberg, 1981; Graves, 1981). In most naturalistic studies, the investigator is a participant-observer.

In the study of one professional writer (Berkenkotter, 1982) the participant composed in his usual environment for writing, making no adjustments in writing time, topic, or procedures. The investigator

collected data on his behavior, analyzed his notes and texts, and talked with him about his processes.*

Classroom studies are designated as participant-observer studies (Edelsberg, 1981; Emig, 1982). In these studies, the investigator functions within a classroom, where he or she narrates the events occurring in that setting. The participant-observer may also assist the teacher and/or the students.

A typical and the best known participant-observer research project is the two-year study by Donald Graves (in Gentry, 1980a). Children were observed before, during, and after writing episodes, and the researchers kept detailed records of the students' writing process. Some of the writing episodes were also videotaped. During videotaping, the student writer wore a small microphone so that the researchers could capture any vocal or sub-vocal behavior. Narratives reporting the behavior of the young writers in the Graves project provide a rich source of data on the composing process.

QUASI-PRODUCT STUDIES

Quasi-product studies have dealt with one element of the composing process: revising activities. Typically, participants compose on a topic during the first session, making changes in their text on that day; the drafts are collected, photocopied, and analyzed. At the next session, the compositions are returned to the writers, who revise by marking on the drafts; then they compose a second draft. Both drafts are collected (e.g., Faigley & Witte, 1981). Drafts are analyzed for

*The researcher collected protocols for some episodes of writing; this procedure is not typical of naturalistic studies. However, the study is classified here as naturalistic because of other features of the project and because the writer contended that talking aloud quickly became natural.

changes to determine, for example, (1) whether the writers decided to add new information to the text or to remove old information, and (2) where and why they made such changes (e.g., Bridwell, 1980; Faigley & Witte, 1981).

In consonance with case studies, these inquiries may compare capable and remedial or novice writers (Faigley & Witte, 1981; Sommers, 1980) and elicit or infer information about their thinking processes (e.g., Beach, 1981; Bridwell, 1980; Sommers, 1980); usually few participants are studied (e.g., Faigley & Witte, 1981; Sommers, 1980), and the writers are generally older students and adults (e.g., Bridwell, 1980; Faigley & Witte, 1981; Sommers, 1980). In contrast with case studies, the product is analyzed rather than observations and/or protocols of the writers (e.g., Bridwell, 1980).

UNIQUE PROCEDURES

Occasionally a unique procedure is used to investigate a particular facet of the composing process. One such technique is "blind writing," performed to study what happens when the writer is unable to read the text he or she is composing. In one study, the writers composed on special paper that does not take an imprint on the first page, only on the carbon copy (Atwell, 1981). In another study, the writers composed with a wooden stylus so that an imprint appears only on the carbon copy of the draft (Gould, 1980). In a third study, writers used invisible ink (Hull, Arnowitz, & Smith, 1981). Consequently, only the researcher can read what is written.

Another unique procedure involves the use of an electroencephalograph to scan the activity of the left and right hemispheres of the writer's brain as he or she composes (Glassner, 1980). During scanning, the device also provides timing information on when the activity levels of the hemispheres vary. The right brain is active when the person is processing spatial, global concepts; the left brain is active when the person is processing linearly. A baseline rate is first established by recording five minutes of hemispheric activity with the participant's eyes closed and five minutes with eyes open. Then the participant composes with electrodes attached to his or her right and left temporal lobes.

The laboratory studies, naturalistic studies, quasi-product studies, and unique procedures have begun to produce some results. These results have already modified the established, scholarly view of the composing process.

RESULTS

Information derived from inquiries using the new methodologies to study writing has discredited the strict linear model of the composing process--prewriting, writing, and postwriting--as an appropriate model for research purposes.* Before the era of the new composing-process research, scholarly literature propounded only theoretical models. These models generally defined three linear stages: The first stage, prewriting, included all the preparatory efforts in generating and organizing, as well as a possible incubation period; the second stage, writing, covered the actual work of putting words on paper; the last stage, postwriting, included evaluating, editing, and revising the completed text (King, 1978).

This interpretation is inappropriate for research purposes because it describes "the growth of the written product, not . . . the inner process of the person producing the product" (Flower & Hayes, 1981b, p. 369). As a process, writing does not move in a straight line from conception to completion: All planning is not done when words are put on paper; all the words are not on paper before writers review and revise. Writers move back and forth among these subprocesses. For example, after text has been composed on paper, the writer may notice a gap for which new content must be planned. Many researchers describe this recursiveness, e.g.,

> . . . planning, transcribing, and reviewing are not one-time processes . . .. Rather, the text grows and changes; planning, transcribing, and reviewing what has been written occur in irregular patterns. (Nold, 1979b, p. 2)

*For pedagogical purposes, however, the linear model is still viable because the activities of each subprocess are more easily presented in separate stages. For example, teaching students to reorder text is easier when a completed text is available to cut and paste.

> . . . [the writer moves] in a series of nonlinear movements from one subprocess to another . . . . (Sommers, 1978, p. 8)

Although researchers variously describe the recursive subprocesses of composing (e.g., Flower & Hayes, 1981a: planning, translating, reviewing; Nold, 1979b: planning, transcribing, reviewing; Gould, 1980: planning, generating, reviewing, accessing other information), the results of the research on composing are described in this paper under these subprocess headings: planning, translating, reviewing, and revising.*

PLANNING

Research findings indicate that planning is a thinking process that writers engage in throughout composing--before, during, and after the time spent in putting words on a page. During planning, "writers form an internal representation of knowledge that will be used in writing" (Flower & Hayes, 1981a, p. 372). More research results are available on planning than on any other subprocess of composing. This research focuses on (1) the elements of planning, (2) the time spent in planning, (3) the kinds of planning done before and during composing, and (4) the differences between competent and remedial writers' planning activities.

Planning elements include generating and organizing content, and setting goals (Flower & Hayes, 1981a). Generating entails gathering information to write about, whether that information is material from external sources or is content discovered within the writer's mind.

---

*Choice of these labels does not imply disagreement with any researchers' categories. Rather, this division represents a practical organization for discussing what is now known about the process of composing written discourse.

Bourne, Dominowski, and Loftus (1979) similarly describe generating as

> Retrieving facts and procedures from the long-term memory
>
> Scanning information available in the environment . . .. (p. 238)

Organizing is ordering content; it contributes structure to a final product. Organizing may involve deleting content when more content has been generated than is needed for the specific purpose and/or arrangement. In actual practice, plans for organizing content rarely include formal outlines (Emig, 1971; Mischel, 1974; Stallard, 1974).

Setting goals involves mentally planning the individual en-route tactics for completing the writing task. Writers may set a number of such goals while developing a complete discourse. Protocols show that goals may be as complex as "Conform to the rules of a genre," as specific as "I'll include an illustration," or as simple as "Write down what I can remember" (Flower & Hayes, 1980b, p. 18).

Writers set two kinds of goals: content goals that govern what to say (e.g., "I'll describe the character"), and process goals that direct the writer's own behavior (e.g., "I think I'll review that part") (Flower & Hayes, 1981a). Some goals specify both content and process, such as "I want to open with a statement about political views" (Flower & Hayes, 1981a, p. 377).

The importance of goals is evidenced by the large number of goal-related activities that appear in writers' protocols. These activities

include setting goals and acting on goals. Table 1 displays the number of goal-related activities that Flower and Hayes (1981b) found at the beginnings of episodes of writing. Writing episodes "are units in the process of the writer rather than in his or her product" (Flower & Hayes, 1981b, p. 234). These units are periods of sustained focus. Boundaries of episodes are suggested by a shift of focus, which can be agreed upon by independent readers (1981b). These shifts in focus typically occur when the writer describes the starting point of the goal, e.g., "Write an introduction" (Flower & Hayes, 1981a, p. 377), and evaluates the success or completeness of the goal, e.g., "That's banal--that's awful" (p. 378).

The quantity and quality of the goals that are set differentiate good and poor writers (Flower & Hayes, 1980a). Good writers create a rich and elaborate network of goals and subgoals that help them generate content, while poor writers concern themselves with statements about the topic (Flower & Hayes, 1981b). Diagrams of actual sets of goals and subgoals and of networks of goals demonstrate the nature and content of the goal-setting process. Such diagrams are found in Figures 1 and 2. Figure 1 displays a writer's actual set of subgoals, and Figure 2, a network of goals.

In addition to setting goals and to generating and organizing content, planning includes such diverse "prewriting" or rehearsal activities as making notes about the topic, drawing (Graves & Murray, 1980, p. 50), and eating or waiting for a bus (Perl, 1979) while deriving ideas. When researchers measure prewriting activities as indicators of planning time, they find that writers do little of their planning before they

TABLE 1

ACTIONS OCCURRING AT EPISODE BEGINNINGS

	Goal Related Actions			Other Actions					
	Goal Setting								
	Setting Content Goals	Setting Process Goals	Acting on Goal	Evaluation	Review	Meta-Comment	Other	% Goal Setting	% Goal Related
Expert 1	10	5	2	1	1	6	6	48%	55%
Expert 2	14	14	16	3	2	3	3	51	80
Expert 3	25	14	17	10	4	4	2	51	74
Novice	20*	5	6	3	7	8	6	45	56
Average	18	10	10	4	4	5	4	49%	68%

*45% devoted to reviewing assignment or earlier goal (Flower & Hayes, 1981b, p. 241).

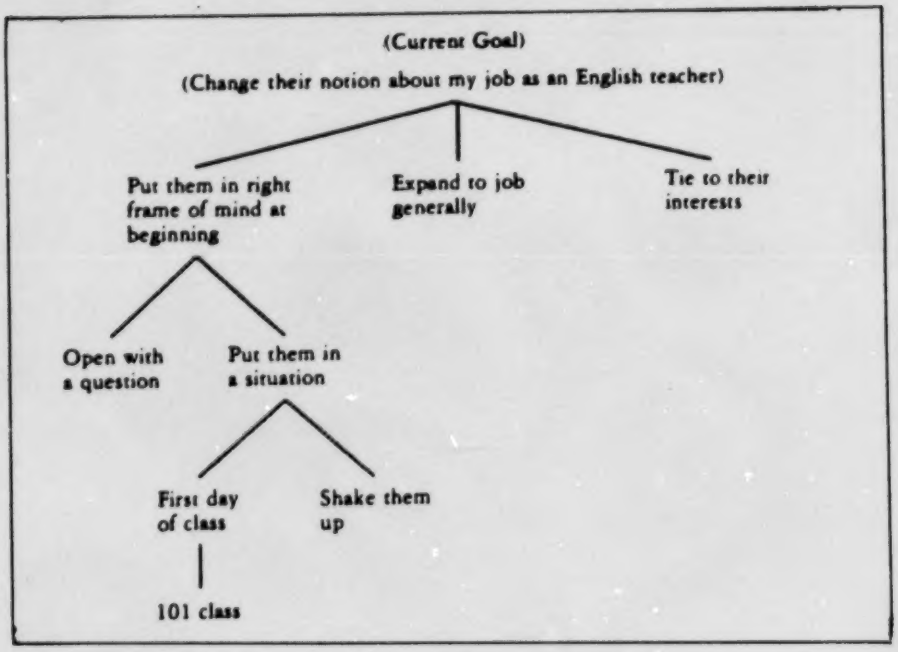
(Current Goal)
(Change their notion about my job as an English teacher)
Put them in right frame of mind at beginning
Expand to job generally
Tie to their interests
Open with a question
Put them in a situation
First day of class
Shake them up
101 class

Figure 1. Writer Developing a Set of Sub-Goals (Flower & Hayes, 1981a, p. 384).

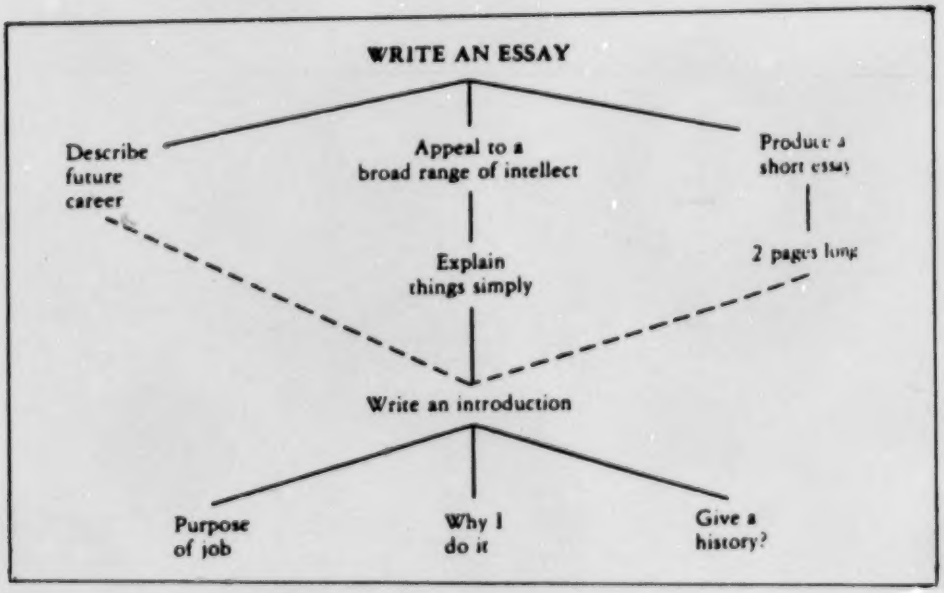

Figure 2. Beginning of Network of Goals (Flower & Hayes, 1981a, p. 378).

translate mental images into words on a page (e.g., Emig, 1971; Mischel, 1974; Perl, 1979; Pianko, 1979). In one study comparing prewriting time and total writing time for high school students, researchers found that only one to four minutes (five to ten percent) composing time was spent in prewriting planning (Stallard, 1974).

In a study with college students, Perl (1979) also found that students spent only about four minutes in planning during the prewriting period. During this time, the students used primarily three different planning strategies:

> (1) Rephrasing the topic until a particular word or idea connected with the student's experience. The student then had "an event" in mind before writing began.
>
> (2) Turning the large conceptual issue in the topic (e.g., equality) into two manageable pieces for writing (e.g., rich vs. poor; black vs. white).
>
> (3) Initiating a string of associations to a word in the topic and then developing one or more of the associations during writing. (p. 328)

These results on planning time as measured during the prewriting period contrast sharply with findings from other studies that suggest planning time is a constant high proportion of total composing time (e.g., Berkenkotter, 1982; Gould, 1980). In these studies, planning required more time than any other subprocess (i.e., translating, reviewing, and revising); planning may consume as much as 65% (Gould, 1980) to 85% (Berkenkotter, 1982) of total composing time. These studies have high totals for planning time because they count not just the time spent in planning during the prewriting period, but also the time spent on planning as composing progresses.

Differences are evident between before-writing and during-writing planning. Before words are put on the page, planning usually entails some general parameters. This global planning also occurs during translating (i.e., putting mental images into words on a page) when writers additionally make paragraph-, sentence-, and word-level decisions (e.g., Flower & Hayes, 1981b; Pianko, 1979). Most in-process planning (as well as some prewriting planning) is mental (Pianko, 1979); a writer who does significant amounts of such unrehearsed, in-process planning evidences high levels of activity in the right hemisphere of the brain (Glassner, 1980, p. 87).

These in-process planning activities, either global or local, usually occur when writers pause (Flower & Hayes, 1981b). Consequently, research on the pause phenomenon provides considerable data on planning. Pause research reveals that short pauses occur when writers are planning their next words or phrases (Matsuhashi, 1981); longer pauses transpire when writers are planning sentences (Matsuhashi, 1981) and global elements (Flower & Hayes, 1981b).

Pause research also suggests that planning time may vary according to the purpose of the discourse: Generalizing and persuading require more planning time than reporting (Matsuhashi, 1981). Figure 3 shows results for four writers in one study on mean pause length prior to T-units (i.e., independent clauses) for these three discourse types.

This same study has shown that planning highly abstract sentences (superordinates) requires more time than planning sentences that add supporting details (subordinates). The opposite is true for individual lexical items: Writers pause for less time before superordinate (general)

terms than before subordinate (specific) terms (Matsuhashi, 1981). Writers pause longer to plan predicates than to plan modifiers, which appear to pour out in a rapid string (Matsuhashi, 1982), and they pause most frequently before conjunctions (Caufer, 1982).

The importance of extensive planning is supported by the finding that good writers spend more time in planning than either average or remedial writers (e.g., Stallard, 1974). Good writers appear also to spend more time in global planning than in local, sentence- and word-level planning; the opposite appears true for remedial writers--they spend more time in local planning (e.g., Atwell, 1981).

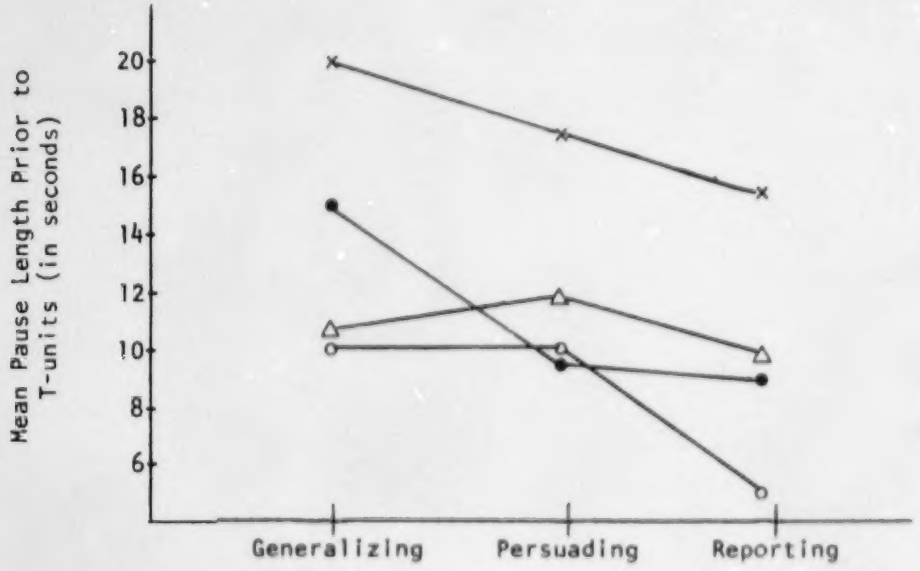

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Figure 3. Mean Pause Length for Three Discourse Purposes (adapted from Matsuhashi, 1981, p. 124).

These findings are corroborated by pause research, which reveals that good writers spend more time in long planning pauses, while remedial writers pause for shorter time periods (e.g., Flower & Hayes, 1981b; Van Bruggen, 1946). Additionally, good writers pause more before they write in thought units (i.e., episodes devoted to communicating concepts or carrying out goals), while remedial writers pause more before sentence-level tasks (Atwell, 1981; Flower & Hayes, 1981b; Van Bruggen, 1946).

TRANSLATING

Terms other than "translating" have been used to label this component of the composing process; these synonyms are cited here because they help define this subprocess. The terms include "writing," "recording," "implementing," "drafting," "articulating," and "transcribing." The term "translating" was selected from the various options as an appropriate label here for the process of transforming meaning from one form of symbolization (thought) into another form of symbolization (graphic representation).

Discussions of research results on translating most frequently deal with the need to make translating skills automatic and with the difference that this "automaticity" makes in a writer's focus on global issues rather than on word-level problems during composing.*

Translating makes huge demands on writers' cognitive processes because translating is so complex: Writers must put ideas into written

*The notion of automaticity has also played an important role in reading comprehension research. Some researchers have argued that children must acquire basic reading skills, such as decoding, on an automatic level before they can comprehend successfully what they read. Indeed, some have argued that this kind of automaticity is the sine qua non of reading comprehension. This issue is discussed by Coots and Snow (1980).

language while they are also dealing with problems of discourse coherence and structure:

> Even a casual analysis makes it clear that the number of things that must be dealt with simultaneously is stupendous: handwriting, spelling, punctuation, word choice, syntax, textual connections, purpose, organization, clarity, rhythm, euphony, the possible reactions of various possible readers, and so on. To pay conscious attention to all of these would overload the information processing capacity of the most towering intellects. (Scardamalia, in Bereiter, 1979, p. 152)

This mental load imposed on translating becomes less difficult as an increasing number of writing skills become automatic rather than consciously driven. "As writers become more sophisticated, they may devote less conscious attention to such concerns as orthography, spelling, and basic sentence construction" (Bridwell, 1981, p. 96).

Being able to "devote less conscious attention" to the skills of translating requires years of practice with handwriting, spelling, language usage, word choice, capitalization, and punctuation; then these skills may become somewhat automatic. Relative automaticity may also be possible for some higher-level skills such as sentence variation and figures of speech (Gould, 1980).

Studies have provided evidence that writing behavior is different after translating becomes somewhat automatic. In one study, marked changes in cognitive processes were measured when writers engaged in a type of automatic translating. The design for this study allowed the participants to select their topics for writing. Some chose familiar topics that did not pose either global or local planning challenges because the writers had rehearsed the topic, either mentally or in

spoken discourse, until they could compose without consciously attending to such aspects as order or word choice or sentence structure. Under these conditions, an electroencephalograph measured higher levels of activity in writers' left brains than in their right brains. Interviews with the participants verified the automatic nature of writing at the time of heavier left-brain activity. One writer, who wrote about an automobile accident she had been involved in, reported,

> I knew the words that I would say, as I have said them before to insurance investigators, lawyers, my family, and friends. It was as if a record was in my head that kept repeating itself. (Glassner, 1980, p. 88)

Another study evidenced a difference in translating speed when skills were more nearly automatic. In this study, participants who had mastered translating skills, as measured by high scores on usage tests, wrote at a rapid rate between pauses. Conversely, participants who had not mastered translating skills wrote slowly. Furthermore, the speed of translating between pauses increased with the increasing age of the subjects (Van Bruggen, 1946), a finding that supports the assumption that older writers are likely to have made more translating skills automatic than have their younger counterparts.

In an apparent, but not real, contradition of these results, some researchers have discovered that good writers write almost half as many words per minute as their randomly chosen counterparts (Flower & Hayes, 1981b). The reason for this apparent discrepancy is that the data is based on the ratio of total words to total composing time. Since good writers pause for a longer time to plan between episodes of rapid

translating, they may write fewer total words. Poor writers, however, pause for shorter intervals during translating. One reason for their frequent, short pauses is that they must stop to think about the mechanics of writing. They have so many mechanical problems that they must "attend to surface matters [in order] to write out their ideas the first time" (Bridwell, 1980, p. 214).

Interestingly, writers who have difficulty with translating skills often evidence some of them in their oral repertoires. This mastery is verified by studies that compare transcripts of oral composing with written products. These protocols reveal both what writers say they are writing and what they actually do write; they use skills in their oral composing that are not reflected in their written compositions. For example, a writer might say he or she is writing "walked," but the word he or she actually writes is "walk." Results for one writer in a study of these "miscues" during four composing sessions are displayed in Table 2 (Perl, 1979).

REVIEWING

Reviewing is characterized by backward movements to read and assess "whether or not the words on the page capture the original sense intended" (Perl, 1979, p. 331). It includes scanning to determine where one is in relation to the discourse plan and to refamiliarize oneself with the already translated text; it also includes judging whether to do further planning and translating or to stop writing because the discourse is complete. Writers also review their texts to proofread for the conventions of written language, to decide on a conclusion, and to determine needed revisions (Pianko, 1979).

TABLE 2

MISCUES OF ONE WRITER FOR FOUR SESSIONS

ENCODING				
Session	Speaking complete ideas but omitting certain words during writing	Pronouncing words with plural markers or other suffixes completely but omitting these endings during writing	Pronouncing the desired word but writing a homonym, an approximation of the word or a personal abbreviation of the word on paper	Total
1	1	4	11	16
2	8	0	14	22
4	4	0	16	20
5	3	1	15	19
	16	5	56	77

(Adapted from Perl, 1979, p. 327)

Reviewing may be intentional or spontaneous (Gentry, 1980b). Some writers review after every few phrases; however, writers more frequently review after they have composed a group of sentences. These "chunks" of information are then reviewed as a piece of discourse (Perl, 1979).

Studies have shown that most writers review, whatever their level of expertise (e.g., Atwell, 1981; Pianko, 1979). Even young writers spend some of their composing time reviewing their texts (Graves & Murray, 1980).

Most research findings on reviewing deal with differences between capable and remedial writers. The findings indicate that when poor writers review, they often do not rethink their compositions as

competent writers do. Furthermore, remedial writers do not review much for elements of style, purpose, and audience. Rather, remedial writers frequently review for errors (Pianko, 1979).

When remedial writers review for errors, they are frequently ineffective because they do not notice their errors; they often read what they intended to write rather than what they actually did write (Daiute, 1981). Protocols that include transcripts of subjects reading aloud their composition expose this miscue behavior. For example, a writer may read in words that are not actually in the composition, a word intended rather than written. Table 3 displays the number of these decoding errors during four sessions for one participant in a study. Table 4 displays the numbers of decoding miscues for all participants across four sessions of the same study.

Studies suggest that capable writers may review their texts more often than remedial writers do (e.g., Atwell, 1981; Stallard, 1974), yet remedial writers appear more dependent upon reviewing. This dependency is evidenced in Atwell's (1981) research, which included a blind-reading condition. This research discloses that remedial writers stray further from the text than do traditional writers (i.e., both good and average writers) when they cannot review. Under blind-reading conditions, the traditional students maintained their high degrees of textual coherence, while the remedial writers wrote somewhat less coherent texts. Atwell explains that the difference occurred because her remedial writers did not have a clear mental plan. "They were, indeed, text-bound and needed to read their texts in order to keep the process moving. In contrast, traditional writers . . . could rely on mental text to keep the composing process recursive and stable" (p. 9). However, even traditional

TABLE 3

DECODING MISCUES OF ONE WRITER FOR FOUR SESSIONS

Session	Reading in missing words or word endings	Deleting words or word endings	Reading the desired word rather than the word on the page	Reading abbreviations and misspellings as though they were written correctly	Total
1	10	1	1	15	27
2	5	1	2	10	18
4*	3	3	0	13	19
5	7	1	2	10	20
	25	6	5	48	84

(Adapted from Perl, 1979, p. 327)

TABLE 4

NUMBER OF WORDS COMPOSED AND TOTAL MISCUES DURING READING

Writer	Total Words				Miscues during reading
	Session 1	Session 2	Session 4*	Session 5	
1	302	512	356	550	84
2	409	559	91	212	32
3	419	553	365	303	55
4	518	588	315	363	147
5	519	536	348	776	30

(Adapted from Perl, 1979, p. 329)

*Data not available for Session 3.

writers deviated slightly from their original plans when they could not review.

REVISING

Definitions for revising have suffered from the linear model of writing that portrays revising as "what the writer does after a draft is completed" (Murray, 1978, p. 87). However, revising is not merely the last stage in a process. Rather, it is a cognitive and physical activity that occurs "continually throughout the writing of a work" (Sommers, 1980, p. 380).

Thus revising is comprised of behavior that entails changing one's mind as well as changing the text. According to Nold (1979a),

> Revising . . . is not just correcting the lexicographic and syntactic infelicities of written prose . . . it also includes (1) changing the meaning of the text in response to a realization that the original intended meaning is somehow faulty or false or weak . . ., (2) adding or substituting meaning to clarify the originally intended meaning or to follow more closely the intended form or genre of the text . . ., (3) making grammatical sentences more readable by deleting, reordering and restating . . ., as well as (4) correcting errors of diction, transcription and syntax that nearly obscure intended meaning or that are otherwise unacceptable in the grapholect. (pp. 105-106)

Thus revising covers editing tasks (e.g., fixing spelling and punctuation, substituting synonyms) as well as major reformulations (e.g., reorganizing blocks of discourse, adding whole sections of content). These changes are made when the writer, in reviewing the text, sees mismatches between an intention and the actual product. This

dissonance between intention and actualization creates tension that must be resolved by revising the text (Della-Piana, 1978; Sommers, 1980).

Revising is the most accessible component of the composing process; it "provides a window into the cognitive operations which occur when a writer writes" (Bridwell, 1980, p. 220). Surprising then is the paucity of research on revising. The most significant studies on revising have been completed by only a few researchers: Beach (1976), Bridwell (1980), Faigley and Witte (1981), Sommers (1980), and Stallard (1974). Most of the research deals with (1) when writers revise, (2) what kinds of revisions they make, and (3) what differences occur among writers with various levels of expertise.

Findings indicate that writers often make more revisions while writing the first draft than they make on the draft after it is completed (e.g., Bridwell, 1980; Faigley & Witte, 1981). Writers also make many changes in subsequent drafts. Table 5 displays the frequencies of revisions at each opportunity for revising during one study that compared the in-process revisions subjects made in the first and second drafts with the revisions they made between drafts. As previously described, the writers turned in their first drafts, marked on their draft when it was returned, and then wrote a second draft.

Unfortunately, first-draft revisions are often premature editing attempts, sometimes by good writers (Stallard, 1974), but more often by poor writers who are so concerned with the surface features of composing (e.g., punctuation, capitalization, spelling, word choice), that they interrupt the flow of composing (Perl, 1979). Correspondingly, they don't use important operations like reorganization and addition

TABLE 5

MEANS, MINIMUM, AND MAXIMUM VALUES
FOR FREQUENCIES OF REVISIONS PER 100 WORDS

Stage	Mean	Minimum	Maximum
A: In-process (first draft)	5.50	0.00	21.87
B: Between-draft	3.24	0.00	13.85
C: In-process (second draft)	8.20	0.56	20.33

(Bridwell, 1980, p. 209)

(Sommers, 1980). Rather, they try to "clean up speech" (p. 381), so they approach revision with a "thesaurus philosophy of writing" (p. 381).

Concern with surface features is characteristic of novice writers, for a developmental difference in the ability to revise is indicated by the research (Bridwell, 1980). Young writers are at first reluctant to mar a page of writing for any kind of change. When they overcome this resistance, they begin to see the draft as temporary. The young writer then gradually extends his/her revision skills (Calkins, in Gentry, 1980a). Even choosing one topic while excluding others is an effective step in acquiring mature revising strategies (Graves & Murray, 1980).

As writers become more experienced and competent, they view revising as a process of structuring and shaping discourse (e.g., Sommers, 1979; Stallard, 1974). They begin to see a first draft as an attempt to

"define the territory" (Sommers, 1980, p. 384), so they keep writing that first draft until they decide what they want it to say. As writers develop, they also become concerned with audience considerations, so they start reviewing and revising their work for its effect on their audience (Sommers, 1980). The differences between mature and developing writers are supported by one study that examined differences between the kinds of revisions made by student and experienced writers. Students made more word- and phrase-level changes than did the adults, with the exception of phrasal reordering. Adults, however, made more sentence-level and theme-level changes (Sommers, 1980). Results of this study are displayed in Figure 5.

In another study (Faigley & Witte, 1981), developmental differences in writers' revising strategies were examined across three groups: inexperienced student writers, advanced student writers, and expert adults. Inexperienced students primarily corrected errors ("formal" changes) and made meaning-preserving changes of the synonym-substitution type. Advanced student writers also made many meaning-preserving changes, both substitutions and deletions; however, they also made many changes affecting the meaning ("structure" changes) in the first and second drafts. Expert adults made relatively few corrections, a substantial number of meaning-preserving changes (although fewer than the other groups), and more changes in the meaning than either group of students. These differences across groups are displayed in Table 6.

High school students' view of revision appears similar to that of inexperienced college writers: surface and word-level revisions accounted for over half their revisions in one study (Bridwell, 1980); see Table 7.

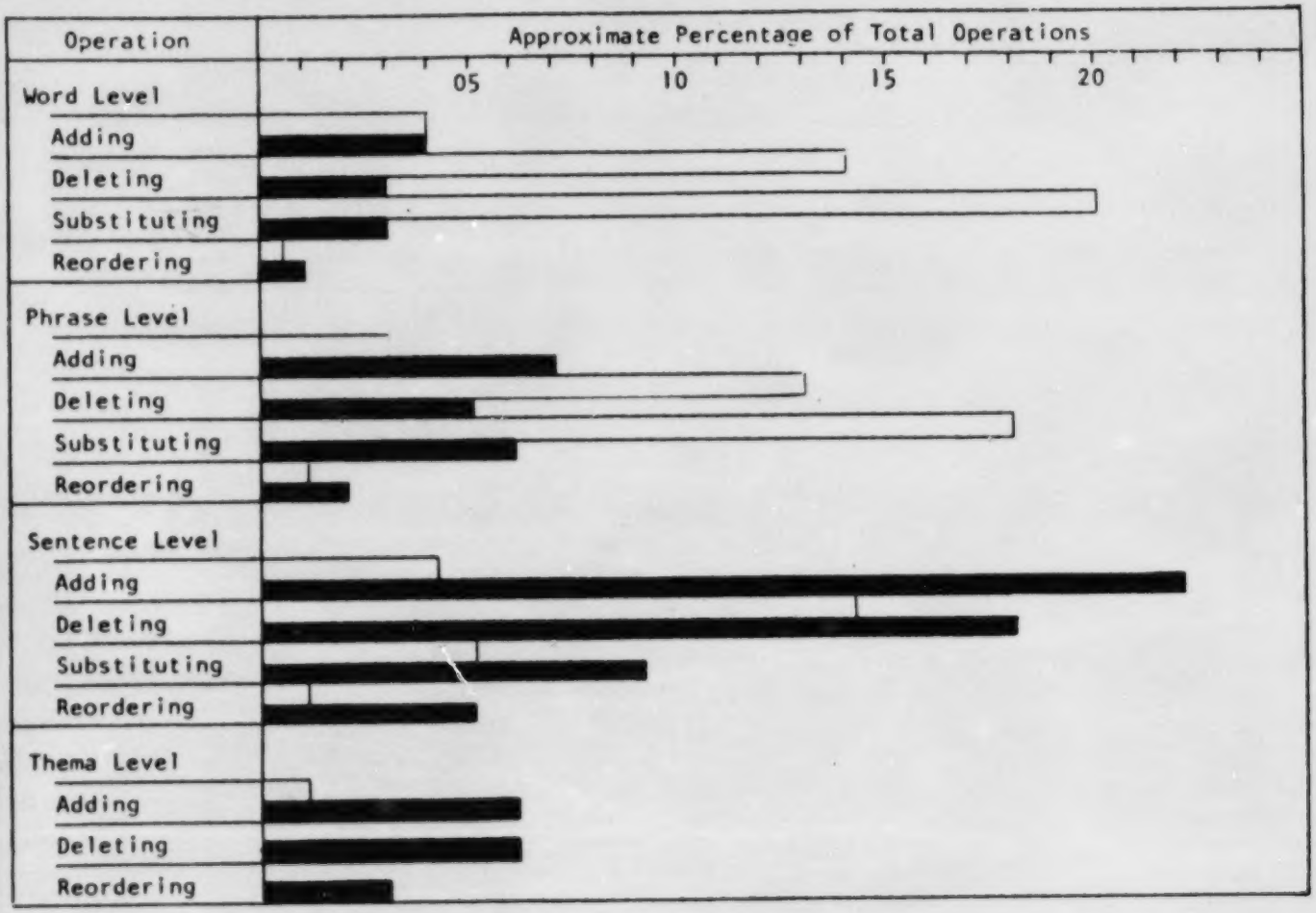

Figure 5. Relative Emphasis of Revision Operations of Student and Experienced Adult Writers*

*Derived from individual tables from Sommers (by Gentry, 1980b).

Results divided the poor writers into two distinct groups--those who revised extensively for surface-level changes, and those who merely recopied their first drafts.

TABLE 6

FREQUENCIES OF COMBINED REVISION CHANGES PER 1000 WORDS IN FINAL DRAFTS FOR THREE GROUPS OF WRITERS

	Formal Changes	Meaning-Preserving Changes	Structure Changes
Inexperienced Students	21%	65%	11%
Advanced Students	18%	58%	24%
Expert Adults	15%	50%	34%

(Adapted from Faigley & Witte, 1981, p. 406)

TABLE 7

PERCENTAGES OF TOTAL REVISION FREQUENCIES AT LEVELS AND STAGES

Level	Stage			Level Percentage
	A	B	C	
Surface	9.00	2.58	13.25	24.83
Word	12.87	5.07	13.30	31.24
Phrase	5.66	3.43	8.91	18.00
Clause	.86	1.22	4.23	6.31
Sentence	1.30	1.63	4.88	7.81
Multiple-sentence	1.16	3.26	7.28	11.80
Stage percentage	30.85	17.29	51.85	

(Bridwell, 1980, p. 207)

SUMMARY

Composing-process research has demonstrated that *planning* occurs throughout composing. During planning, writers set composing goals and generate and organize their ideas. Planning consumes a high proportion of composing time, but writers plan only for brief periods before they start translating their ideas on paper. This planning that occurs before translating defines some general parameters, while in-process planning entails global as well as paragraph-, sentence-, and word-level decisions. When writers pause, they are usually planning, and the length of pauses corresponds with the type of planning. Because it is such a significant element of the composing process, differences in planning behavior separate good from poor writers, with good writers spending not only more time in overall planning than poor writers do, but also more time in global rather than local planning.

Translating, which is synonymous with terms like "drafting" and "articulating," is the subprocess of transforming thought into its graphic representation. Writers deal with a heavy mental load during translating. Consequently, writers translate more easily as the requisite skills become more nearly automatic. Correspondingly, writers for whom these skills have become somewhat automatic can translate relatively rapidly and can also devote more conscious attention to global issues during composing.

Reviewing occurs throughout composing. Writers review their texts to appraise what has been done and what needs to be done. Good writers review to rethink their texts and to attend to elements of style, purpose, and audience. Poor writers, who are more dependent

on reviewing, search for errors. Yet these same writers often miss errors because they read into the text what they intended to write rather than what they actually did write.

Revising is behavior that entails mentally changing the content and structure of the discourse as well as changing the actual, translated text. This subprocess covers a range of behavior from simple editing to substantially reformatting whole texts, and these behaviors occur before, during, and after composing a draft. Writers evidence developmental differences in the ability to revise. In early stages of proficiency, they concentrate on correcting errors and changing surface features in their texts. As they mature, writers progressively concentrate on restructuring and shaping their discourse, redefining their ideas as they compose, and adjusting their writing to meet their audience's needs.

LIMITATIONS AND CONCLUSIONS

LIMITATIONS

Much important information has been derived from a small body of research because new methodologies for investigating the composing process produced results not attainable by older, more traditional strategies. However, even researchers within the field are tentative regarding the validity of generalizations derived using the new designs. Criticism has also been leveled at specific features of the designs and the concomitant assumptions that are made.

Proponents of the naturalistic method challenge results from both classical research and laboratory case studies because the designs of these methods do not consider the context for writing; researchers provide no descriptions of contexts and assume that writing in a laboratory and writing in a naturalistic setting are similar (Edelsberg, 1981; Emig, 1982). Both naturalistic-study proponents and case-study people are skeptical about the product-examination designs of researchers who investigate revising; they contend that researchers cannot make assumptions about the process by counting features in the product.

Numerous specific features and assumptions of the new research are also challenged. One such feature is the occasional disregard for situational variables such as the purpose for the task and the writers' familiarity with the task, subject, and audience; processes vary significantly "with changes in assignment, context, audience, and purpose for writing" (Bridwell, 1980, p. 218). A related concern is that the researchers rather than the writers often select the writing task. Under this circumstance, writers deal with a process different from

the one implemented to transform "experience [into] self-chosen writing problems" (Newkirk, 1982, p. 86). Furthermore, the writing is often timed, yet timing constraints do not allow subjects to become involved and committed to the writing task; writers need time to plan and develop their ideas and to shape the structure of their texts.

Many critics have reservations about the participants in the studies. The sample population is frequently too small to allow generalizable conclusions; yet they are made. Additionally, participants in most studies are high school seniors, college students, and adults; few studies deal with younger writers, but the processes of young and mature writers are obviously different. Furthermore, the validity of participants' responses during their interviews is questionable: Writers may not accurately report on their current practices because of individual sensitivity; they may not remember well enough to answer questions about past writing behavior; they may tell the investigator what they think he or she wants to hear. Finally, economic status, ethnicity, and mental age are not discussed as influential; however, these factors should be part of the reported data (Gentry, 1980a).

The strongest criticism, however, is directed toward the oral-composing feature in many studies. Writing situations that require participants to compose aloud for an audience (either an investigator or a tape recorder) are unnatural, despite reassurances by one professional writer that the composer quickly becomes at ease (Murray, 1982). The requirement places additional demands on the writing and distorts the process--it transforms the writing process into a different process, a hybrid of writing and speaking. Furthermore, many writing activities occur simultaneously, from "unconscious processes such as ordering the

words in a noun phrase to conscious processes [such as] planning and monitoring" (Faigley & Witte, 1981, p. 442). Much goes on that is not and cannot be verbalized. Finally, researchers implement a selection process when they search for individuals who can do adequate oral reporting while composing. This selection factor alone distorts the research results by introducing bias in the sample population.

CONCLUSIONS

Despite their limitations, the new methodologies have produced important information. Without this body of research, little would be known about the composing process. If all that the methodology accomplished was to orient attention toward the process and away from the product of writing, the research would be successful.

But it has accomplished much more. It has verified what most competent writers know intuitively about the recursiveness of the process and about the subprocesses of composing. It has pointed out patterns that have credibility because they appear consistently across studies. One important pattern shows that the composing process of successful writers is different from that of poor writers. Successful writers plan more and at a higher level. They review for global aspects of discourse and work more on these higher-level elements when they revise. Thus the research also provides orienting information for teachers of writing: To help more writers become successful writers, writing instructors must guide students toward becoming higher-level planners, reviewers, and revisers.

The research effort has come a long way since 1963 when Braddock, Lloyd-Jones, and Schoer made the often quoted statement comparing research on composition to "chemical research as it emerged from the period of alchemy" (p. 5). We researchers and teachers are not alchemists any longer, but we still believe that maybe we can discover that formula for producing gold.

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